Vol. 17.] OCTOBER, 1946. [No. 3.

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So many requests are received from abroad for parts of the *Agricultural Journal* which were never published that the following list of all issues published and those which are not now available is given for reference. Attention is especially directed to Volume 7 which had only one part :—

Vol.
1. 3 numbers, 1928.
2. 4 ,, 1929.
3. 3 ,, 1930. (None).
4. 4 ,, 1931.
5. 2 ,, 1932. (None of No. 2).
6. 2 numbers, 1933.
7. 1 number, 1934.
8. 4 numbers, 1935-37 (None of No. 4).

Vol.
9. 4 numbers, 1938 (None of Nos. 2 and 3).
10. 4 numbers, 1939 (None of Nos. 2 and 4).
11. 4 numbers, 1940. (None).
12. 4 ,, 1941 (None of Nos. 1 and 2).
13. 4 numbers, 1942.
14. 4 ,, 1943.
15. 4 ,, 1944.
16. 4 ,, 1945.

ISSUES OF THE AGRICULTURAL CIRCULAR.

NUMBERS and year of issue of the *Agricultural Circular*:—

Vol. 1, 1920, 12 numbers.
,, 2, 1921, 5 ,,
,, 3, 1922, 4 ,,
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,, 5, 1924–5, 2 numbers.

As number 4 of Vol. 3 was printed as " Volume 4 " and number 1 of Vol. 4 as " Volume 5 " it would appear from an inspection of a complete set that Volume 4 comprised only a number 4 and that there were two issues of Volume 5, No. 1.

ANNUAL BULLETINS.

THE Annual Bulletin of Divisional Reports ran from 1931 to 1938 and was then discontinued.

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9. Soils of Fiji—I., 1916.
11. Alluvial Soils of Fiji, 1919.
12. Leaf Moth of Coconuts, 1919.
13. Sea Island Cotton, 1920.
14. Transparent Coconut Scale, 1921.
15. Purple Leaf Moth of Coconuts, 1924.
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18. Control of Coconut Spike Moth, 1935.
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—EDITOR.

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AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 17.] OCTOBER, 1946. [No. 3

EDITORIAL.

READERS of this Journal will recall that in the March issue of this year the Director of Agriculture, in an editorial, summarized the Memorandum on Agricultural Policy which was adopted by Legislative Council at the February Session.

For the first time in the history of the Colony a clear agricultural policy has been defined and accepted by the Legislature of this country and it will be the duty of Directors of Agriculture to implement and develop it in keeping with our problems and resources.

In order to facilitate the development of the plan it has become necessary to reorganize and strengthen the Department of Agriculture by the provision of modern facilities and additional specialist and technical staff.

Of first importance will be the establishment of three agricultural stations, two in Viti Le-u and one in Vanua Levu; in addition, the programmes of the present farms at Dobuilevu in Ra and at Sigatoka will be modified and the stations developed—in accordance with the Paterson–Dodds Report —as district farms.

Additional staff will include a Deputy Director of Agriculture, Economic Botanist, Soils Chemist, Animal Husbandry Officer, Weed Control Officer, Marketing Officer, Agricultural Education Officer, two Live Stock Officers, four Agricultural Assistants and a Farm Manager. The Agricultural Officers will be reduced by one, and two of these will be styled agronomists for service on the main stations.

The duties of the directorate and certain of the technical staff will include services for the British Solomon Islands Protectorate, the Gilbert and Ellice Islands and the Kingdom of Tonga: for such services the territories concerned will contribute two-fifths of the recurrent expenditure. The expenses of the Extension and Station Services, Fiji, will be borne by Fiji.

The staff of the department will be concentrated on the main stations of the Colony with the exception of the directorate, the marketing and produce sections and the chemical laboratories. The executive work will be divided into two distinct sections, namely, extension and advisory services and investigation services; and the whole co-ordinated by the directorate with the assistance of two small departmental committees. Ultimately, when the reorganization has advanced sufficiently it is proposed to set up an Agricultural Advisory Committee representative of the main agricultural industries of the Colony to examine the work and proposals of the department and to advise the Director on practical problems requiring the attention of agricultural services.

Pending the acquirement of suitable stations, field investigations have been reduced to a bare minimum at Naduruloulou and Dobuilevu. The Waimaro farm has been closed and the work on the veterinary station at Nasinu has been transferred to Sigatoka where opportunity will be afforded the Senior Veterinary Officer of raising stock under intensive farming conditions as practised in the British West Indies. The new programme for the stations has been laid down and will be discussed in a subsequent issue of the Journal.

It will not be possible to proceed with the Shephard investigational plan until such time as staff and facilities exist; in the meantime, the Senior Agricultural Officer (who is also performing the duties of the Economic Botanist) is confining investigations to projects in connexion with weed control, the raising of new fodder crops and banana disease control. An important interim function of stations is the holding of economic plants for the maintenance of pure-line seed and other planting material.

While it has not been possible as yet to reorganize the Scientific Services in the approved manner, important steps have already been taken to put the extension and advisory services on a new footing. These services are of first importance to the farming community and every effort is being made to concentrate the staff in centres of agricultural activity. It is not expected that the full value of the change will be felt until the vacancies in the ranks of the Agricultural Assistants and Stock Inspectors have been filled; the important change is that there is now available the nucleus of a group of technical officers who, freed from station work, will be able to concentrate on advisory and extension duties.

The Research and Extension Committees of the Department have met to consider in detail the programme laid down in general terms in the Paterson-Dodds Report. As a result an interim plan has been devised in keeping with present facilities and in line with the practical agricultural requirements of the Colony. —W.J.B.

USE OF DDT AND 666 (GAMMEXANE).

THE necessity of taking full account in agricultural trials of the effects of D.D.T. and Gammexane on parasites, predators and pollinators in view of the possible dangers to beneficial insects which might attend the widespread or indiscriminate use of those insecticides has been brought to the notice of readers, but until recently no authoritative guidance has been available on the use of these insecticides in direct contact with foodstuffs.

Although at the normal strengths in which D.D.T. and Gammexane are used in sprays and dusts they have been found to be harmless to human beings (and livestock), it is advised that, in view of the lack of knowledge of the cummulative toxic effect of these insecticides on human beings, their use in direct contact with foodstuffs, particularly fatty foods, should for the present be avoided.

It would appear desirable, therefore, to refrain from the use of D.D.T. and Gammexane in direct contact with foodstuffs, for example, direct application to stored grain. In their use in food stores and dwelling houses reasonable precautions should be taken to prevent the contamination of food and drinking water.

AGRICULTURE IN THE BRITISH SOLOMON ISLANDS PROTECTORATE.

By
W. J. BADCOCK,
Senior Agricultural Officer, B.S.I.P.

In general the main islands of the British Solomon Islands Protectorate are mountainous with knife edge ridges and deep narrow valleys, but on some islands there are appreciable areas of alluvial valleys. Along the north-east coast of Guadalcanal there are fairly extensive grassy plains, there is also a considerable area of fertile undulating land across the middle of Ysabel Island. Ontong Java, Sikiana and the Swallow Islands are typical atols. Rennell Island is a raised atol, while Tikopia, Anuta and the Duff Islands are of volcanic origin.

Geology and Soils.

The geology of the Solomon Islands has resulted from volcanic action and violent earth movements. This has resulted in rocks being broken and twisted, many formations are therefore very local.

In general coastal areas are dominantly calcarious, many being of very recent formation due to the raising of coral reefs.

There are fairly extensive areas of limestone rock, and in places traces of marble. The central ranges of the main islands are dominantly basaltic, this is probably the most extensive formation in the territory. There are limited areas of sandstone, conglomerates and soap stone, these are usually found together, in thin layers. On Malaita in the vicinity of Tai lagoon there is an area of schists.

On the south-west coast of Guadalcanal there is a small area of carboniferous rocks, and gold bearing rocks have been found in the central range of the same island. There are said to be metal bearing rocks on Ysabel and South Choiseul, but no record is available of any geological survey of those areas.

There are three main soil types, namely:—

1. Truly volcanic.
2. Mixed soils resulting from violent earth movements.
3. Sedentary.

It has been impossible to make more than the most rudimentary examination of the distribution of the various soil types, as this would necessitate employing, for a lengthy period, a large staff of soil chemists, which could not be justified at the present stage of agricultural development. The following notes will serve to give some indication of the distribution of the main types.

The soils on Rendova and Kolombangira Islands are believed to be the only truly volcanic soils. The soil on these islands is deep chocolate brown in colour, of good texture and high fertility.

Vella Lavella and New Georgia groups of islands seem to have been formed by volcanic eruptions pushing up through what might previously have been fairly level islands. On Gatukai and Vangunu Islands for instance, there are deep ravines leading from the main crators, thus the whole islands appear like pushed up crusts. The rock strata is therefore pushed up towards the centre of the islands, and broken by ravines. The surface soils are mixed. The top layer is in places volcanic dust over a layer of thin coral, with a subsoil of red clay. In other areas there are brown loams over red clay, while in the valleys the soil is darker due to the lack of aeration

and the clay is yellow in colour for the same reason. Choiseul, Ysabel and Malaita seem to be very similar in type and probably have a uniform geological history. On all three islands there appears to be a central core of basaltic rock, above this there are conglomerates, sandstone and soapstone, and more recently formed rocks of limestone and coral. The north-west end of Choiseul is dominantly lime stone and coral, further south there are mixed formations, while the extreme south is very rocky country dominantly basalt.

Ysabel has a periphery of limestone and coral rocks while the centre is somewhat less mountainous than Choiseul. In general the island can be regarded as the most fertile in the group, with quite extensive areas of alluviums. The central range of Ysabel is believed to be rich in minerals.

The whole of the north, south-west and south Malaita is dominated by limestone formation. On the north-east coast the formations are more mixed, there are small areas of sandstone, conglomerates, soap stone, and a limited area of chists in the vicinity of Tai lagoon. The centre of the island is dominantly basalt with some serpentine. From an agricultural point of view Malaita is very difficult country being extremely rugged and hilly.

The Island of Guadalcanal is quite distinct, having a fairly extensive area of plains. Along the south-west side there is a range of quite high mountains. Mt. Popomanasiu in this range is over 8,000 feet in height being the highest in the group. This range of mountains contains a number of different rock types, but as on other islands basalt is by far the most common. There is a small area of carboniferous rock near Viso on the south coast and due south of Ilu, gold bearing rocks have been discovered. Along the north-east coast there is an extensive area of alluvial plains.

San Cristoval differs from the other main islands in that it is dominantly basaltic in origin. The country is very broken, but there are appreciable areas of valley alluviums.

The Florida group of islands has a closer affinity to Guadalcanal than any other island in the Protectorate. The country is extremely broken but there are no very high hills. On the north side there are considerable areas of grass land, this is partly natural, but much of it is artificial; the growth of bush being prevented by annual grass fires. The soils on these grassy areas are very leached and light in colour. The forested areas are fairly fertile.

The Santa Cruz group of islands is much like San Cristoval, being dominantly basaltic in formation. There is however a considerable area of limestone rock around the Craciosa bay area of Santa Cruz Island.

Enough has already been said concerning the small islands to indicate the nature of the soils to be found on them. It is now necessary to comment on the soils associated with the various formations mentioned.

In limestone areas the soil is usually very dark in colour and clayey. On hillsides which are well drained the soil is productive, but on level ground becomes water logged and of low agricultural value. Soils formed on hillsides over basalt are chocolate brown, with a red clay subsoil, on low land the soil is darker in colour and the clay yellow due to lack of oxidation. These soils are variable in fertility depending on the depth of soil over the clay subsoil. In areas where sandstone, conglomerates and soap stone occurs there are very fertile soils. Unfortunately the area of this type of soil is relatively small. A striking feature on the main islands is the red subsoil

exposed in most places where there has been any serious soil erosion. These areas of red subsoil, due probably to laterization, appear to represent the most extensive soil type in the Protectorate. The most difficult thing to combat in the Solomon Islands, with any permanent system of cropping, will be leaching, due to the heavy rainfall, and the porous nature of most of the surface soils. On first impression it appears as though the islands are very fertile, closer examination however, reveals the fact that while there are very appreciable areas of highly fertile land, the general level of fertility is below average.

Climate.

The climate of the Solomon Islands is wet, hot and humid. The rainfall varies between wide limits in different localities, and from season to season. Highest recorded rainfalls are from Vanikoro in the Santa Cruz group with an average annual fall in excess of 200″. The lowest rainfall has been recorded at Ilu on the Guadalcanal plain with an average of 70″ per annum. All rainfall records have been kept on coastal regions and it is generally considered that greater precipitation occurs in the mountains. It has been suggested that the rainfall might exceed 400″ per annum at higher altitudes.

The temperature range is between 73° and 95° at sea level. Temperatures as low as 49° have been recorded at 6,000 feet, and in one instance a temperature of 104° was recorded on Guadalcanal plain. The humidity is very high being in the vicinity of 80 per cent.

These are two main seasons, that of the south-east trade winds from May to November, and the north-west equatorial wind from December to March, the latter is rather unpleasant being hotter and more humid.

Flora.

The vegetation of the Solomon Islands is dominated by arborescent species, containing a large variety of trees and palms. From the air, with the exception of the Guadalcanal plain, the entire group of islands, appears to be covered with luxuriant forests. From an agricultural point of view the most interesting feature of the forest is the presence of a number of types of wild bananas. It also provides considerable quantities of nuts and fruits contributing very materially to the local diet.

On the plain of Guadalcanal there are two dominant grass species, Kangaroo grass(1) and the swamp reed(2). The latter is confined to the wetter areas and the former is found on drier areas and hill sides.

Other common grasses include the following: Sour grass(3), Burr grass(4), Seed grass(5), Goose grass(6), Crab grasses(7), Blady grass(8), common Carpet grass(9), Crowsfoot grass(10), Mission grass(11), Bermuda grass(12) and a species of *Sorghum*.

1 *Themeda australis* (R. Br.) O. Kye.
2 *Phragmites karka.*
3 *Paspalum conjugatum* Berg.
4 *Cenchrus echinatus* L.
5 *Chrysopogon aciculatis* (Retz.) Trin.
6 *Eleusine indica* (L.) Gaertn.
7 *Digitaria* spp.
8 *Imperata cylindrica* Beauv.
9 *Axonopus compressus* (Sw.) Beauv.
10 *Dactyloctenium ægyptium* (L.) Richt.
11 *Pennisetum polystachyon* Schult.
12 *Cynodon dactylon* Pers.

Other plants of economic importance include the following: Several species of tropical trefoils or so-called Solomon Island clover[1], Chinese burr[2], sensitive plant[3], common Paddy's lucerne[4], Tobacco weed[5], and Hibiscus burr[6].

The Colony is singularly lacking in a number of common useful fodder grasses, such as Guinea grass[7], Rhodes grass[8] and Para grass[9].

The *Desmodiums* provide good ground cover and good grazing. The local variety of Sensitive plant, unlike the one found in Fiji, is of little value for grazing owing to the presence of spines, it is thus regarded as a noxious weed, difficult to eradicate. Other plants mentioned are common weeds. In addition to the plants named, Koster's curse[10] has recently been discovered on small Malaita, and has been reported in the Shortland Islands group.

Fauna.

The animal life of the Solomon Islands is very limited for a tropical country. Indigenous mammals include the pig, dog, cat, opossum and number of rats. The Solomon Islands pig, which is present in large numbers, is probably the parent of the domesticated animal. Wild dogs are numerous on some islands, they appear to subsist on wild pigs. The opossum and edible rat are popular items of native diet.

Reptiles include crocodiles, snakes and lizards. Crocodiles are numerous in a few rivers. There are relatively few lizards and snakes. There are no large snakes and few are venomous.

The bird life is dominated by highly coloured parrots and cockatoos, some of these are very destructive to crops. Useful birds include duck, pigeons, hornbills, megapodes, and the wild fowl[11].

There is an entire absence of any of the larger game animals, and many game birds usually found in tropical countries. It is also surprising that anthropoid apes are entirely absent.

The insect life is not so varied as is common in the tropics, there is a welcome absence of many biting insects, though mosquitos and sand flies are in places numerous. There are many magnificent butterflies and moths, these represent the most striking feature of insect life in the territory.

Land Tenure.

The following list gives the acreages held by Europeans under the more important regulations:—

Freehold	.. .. ..	307,000 acres
Crown lease	.. .. ..	40,000 ,,
Native lease	.. .. ..	4,000 ,,

As stated earlier only a small portion of the alienated land has been developed, but as there is nowhere on the main islands any land shortage, the fact that large areas have not been made available to the indigenous population has not caused any hardships.

Inquiries indicate that ownership of native land is universally recognized, but the so-called owner almost invariably proves to be the head of a family or line, and as such administers the land. After careful inquiries covering practically the entire group, no authenticated case of individual ownership

1 *Desmodium triflorum* DC.
D. heterophyllum DC.
D. polycarpum DC.
2 *Triumfetta bartramia* L.
3 *Mimosa pudica* L.
4 *Sida rhombifolia* L.
5 *Elephantopus mollis* HBK.
6 *Urena lobata* Benth.
7 *Panicum maximum* Jacq.
8 *Chloris gayana* Kunth.
9 *Brachiaria mutica* Stapf.
10 *Clidemia hirta* Don.
11 *Gallus gallus* L.

has been discovered. It seems almost certain therefore that in instances where individuals have negotiated sales of land, they have acted as the representatives of a family, family group or line.

The individual's right to cultivate land generally includes any unoccupied land owned by his tribe subject to the "owner's" permission. A tithe is usually paid to the owner, but it does not appear in general to be obligatory. It is surprising that land titles are so jealously guarded in a territory with so many thousands of square miles of unoccupied land.

Native Agriculture.

Native agriculture is extremely primitive, the pointed stick being by far the most common tool used for cultivating and lifting crops. It is, however, quite an effective tool, and the fact that more efficient cultivating tools are not used, no doubt, accounts in a large measure for the lack of any serious soil erosion. The method of cropping is a form of shifting cultivation with bush fallows of from three to seven years in length. When new land is cleared much work is involved in clearing heavy bush growth, or forest trees. This heavy clearing is done by men. Cultivating and planting is done by both men and women, though in places there are tabus regarding women cultivating certain varieties of yams and taro. Taro and yams are always grown on new land followed by one or more crops of sweet potatoes, prior to allowing the land to revert to bush again. Taro, yams and sweet poratoes are the only important annual crops grown. Minor crops include maize, beans, ginger, turmeric, bananas, and tobacco together with a few vegetables including Chinese cabbage, Hibiscus(1) and Solanaceous specias. Permanent crops include coconuts, breadfruit, betel nuts, citrus, pawpaw, and in places Nali nuts are planted.

The diet obtained from cultivated crops is thus lacking in proteins. This deficiency is made good by collecting wild nuts of the following trees: Solomons Almond or Kanary nut(2), edible Vutu(3) and Indian almond(4). Wild fruits collected include the Polynesian plum(5), the Fijian "dawa"(6) and the mountain apple(7) and species of *Sapotea*. It is thus obvious that while cultivated crops produce dominantly starchy foods, the vegetable diet is well balanced with forest products.

The only cash crop grown prior to the war was coconuts for the production of copra. Just immediately prior to the war an attempt was made to encourage rice growing, both as an adjunct to the local diet and for satisfying estate requirements, but a number of unavoidable circumstances made adequate arrangements for marketing impossible. Ivory nuts from the sago palm(8) were also collected for sale, the sago obtained from this palm is not a very popular food, probably because it is not as palatable as that obtained from the commercial species(9).

Agriculture on native land has hitherto been very largely on a subsistence basis, the result partly of primitive methods of farming, but mainly no doubt due to a large proportion of able bodied men being employed on European owned estates; lack of marketing facilities, however, was an important contributory factor. Animal husbandry is largely confined to pigs, which, except on remote Polynesian islands, are kept in considerable numbers.

1 *H. manihot* L.
2 *Canarium mehenbethene.*
3 *Barringtonia edulis* Seem.
4 *Terminalia catappa* L.
5 *Spondias dulcis.*
6 *Pometia pinnata* Forst.
7 *Zyzygium* sp.
8 *Metroxylon salononense.*
9 *M. Sagu.*

Formerly they were allowed to wander round the villages and were housed with the people, they obtained their food by foraging and were encouraged to eat human fæces. This method of management is now uncommon, but still persists in some of the more primitive villages. As the result of constant propaganda by Administrative Officers the bulk of the domestic pig population is confined to some kind of enclosure. Many villages have large stone walled paddocks, sometimes exceeding 100 acres in extent. In these, pigs feed largely by foraging but receive in addition quantities of sweet potatoes, yams and taro. Smaller village enclosures in the region of 200 square yards in extent are also common, in these the animals have to be fed and watered. Many of the salt water people build small sties on piles over the sea, usually to accommodate one pig which they fatten for their feast days. Pigs are not slaughtered regularly to provide a steady meat ration, but in batches of 40 or more on feast days, the people then gorge themselves on meat which does them little good, and then go without for a lengthy period until the next feast day. There are few natives owning cattle, and there is no strong desire to obtain them. This is due in part to the lack of pastures, but probably mainly due to the fact that the value of milk as a food for children is not appreciated. A number of mission centres maintain herds of cows, these are kept in part for providing a milk supply for the European members of the stations but probably mainly to provide milk for orphans and sick patients at their hospitals.

Missionaries state they have difficulty in teaching natives to milk cows; and often after learning they find the need for milking twice a day very irksome. This restriction on the individual's movement and the need for constant attention is, perhaps, the real reason why the native does not take readily to keeping cows. He hates to have his freedom of movement restricted.

Natives owning cattle have in all instances had lengthy contact with Europeans either in Australia or on coconut estates.

As far as it has been possible to ascertain no natives own goats. This is unfortunate as they would almost certainly flourish in the territory and in fact do at a number of Mission centres. They would provide a useful source of meat and milk for the ordinary peasant.

Fish constitute an important place in the daily diet of all coastal people and bush people obtain supplies by exchanging their root crops for fish at regular markets.

The agriculture practice of the Polynesians is very similar to that of the Melanesians except that coconuts are more extensively used. Their diet includes more fish and coconut dishes than is commonly eaten by Melanesians.

The entire absence of any fermented liquor on Melanesian islands is noteworthy. Betel nut chewing is very common and often indulged in excessively. The Polynesians are addicted to Betel nut chewing, they also prepare and drink toddy and follow the ritual of kava drinking. Excessive tobacco smoking is indulged in by a large number of inhabitants.

Plantation Agriculture.

The area of land alienated amounts to approximately 400,000 acres; of this only 62,610 acres have been utilized for crops, the remainder is mainly virgin land covered by forest. Of the area developed, 62,309 acres are under coconuts, thus this crop dominates estate agricultural economy. The annual yield of copra prior to the war amounted to approximately 21,000 tons valued at about £300,000, representing 85·7 per cent of the total value of exports. Minor crops grown on estates included cocoa, rubber and

ivory nuts. Attempts have also been made from time to time to grow cotton, coffee, and kapok commercially; failure to establish these crops appears to have been mainly due to shortage of labour.

In many instances land selected for coconut growing was unsuitable for the crop; thus low copra prices which prevailed prior to the war forced many low yielding estates out of production. Some of the best estates situated on the Russell Islands gave in a few instances yields in excess of one ton of copra per acre annually and were very profitable.

On many estates the potential yield of copra was seriously depressed by "nutfall" caused by the coconut shield bug[1] for which as yet no effective means of control has been discovered. It has been suggested that high incidence of the insect is associated with poorer soil types, and that the effect of the insect's attack is intensified by the lack of vigour in the palms. Support for this theory can be deduced by the fact that no case of serious "nutfall" has been reported on the better soil types.

On many estates herds of cattle were maintained, these assisted greatly in keeping the estates "clean", provided quantities of meat for feeding labour and milk for the Plantation Manager. Pigs were also kept in considerable numbers, these found a ready market among local natives. Horses were kept on many plantations. They were used by the Manager for riding on his daily inspection, and for visiting neighbouring estates. Prior to the war in addition to plantation agriculture, European firms were exploiting timber on Vanikoro and Faisi Islands and gold prospecting was being actively pursued on Guadalcanal.

Commercial Crops.

Coconuts.—This crop has hitherto dominated the whole economy of the territory. It is probable that the total area under this crop exceeds 100,000 acres but much of this had been abandoned prior to the war and the cultivated area probably did not exceed 60,000 acres all of which is at present in a very neglected condition. Since there are relatively large areas of coconuts and the ruling price of copra is comparatively high, active measures to re-establish marketing should be taken at an early date. Besides being a commercial crop, on a number of small islands and on coastal areas it provides a valuable source of food both for man and his livestock—pigs and poultry.

Cotton.—Crops of cotton have been successfully grown on a number of islands, but labour was unobtainable for harvesting and crops had to be abandoned.

Kapok.—Kapok has been planted in places and has given good yields but it has been unable to compete with kapok from established sources of supply.

Cocoa.—Cocoa has been planted on a number of isolated areas, only one has been visited, this was an area not particularly suitable for the crop and it had received no attention for a number of years. The crop however was healthy and producing a number of small pods. There seems little doubt that the climate of the territory is admirably suitable for cocoa and if care is exercised in selecting land for planting good crops might grown. No area has been seen on which it might be considered practicable to encourage native cocoa growing. There are quite extensive areas of suitable soil of Rendova and Kolombangira Islands, but the population on both is very sparse.

Rice.—Trials with this crop indicate that it can be successfully grown throughout the Solomons. It is a popular food and if suitable marketing facilities are provided adequate rice might be produced to satisfy local

[1] *Amblypelta cocophaga* China.

requirements, these in pre-war days amounted to 1,500 tons per annum. The crop has done particularly well on the Guadalcanal plain at Ilu, where a Government rice production scheme is operating with success.

Any surplus produced in the territory would probably find a ready market in Fiji or New Zealand.

Ivory Nuts.—Ivory nuts have been grown commercially, and prior to the war the area under this crop was being extended. The market however could be easily over-supplied, so that it will be necessary to increase production with caution.

Coffee.—Coffee has been planted in a number of places, but all the trees seen have been types of Arabica. These have been at sea level and have therefore failed to flourish.

It is probable that Robusta coffee would flourish on selected sites, but it is doubtful if it would be worth producing owing to the lack of markets.

Food Crops.

Taro.—Taro(1), both swamp and dry land types, are grown. These together constitute the most important food crops of the territory. The standard of cultivation is generally high and it is doubtful if, except by irrigation, much could be done to improve on native cultural practice.

Yams and Pana.—Pana(2) is by far the most popular, and does in fact provide an excellent substitute for the European potato. There are many varieties grown, yields are generally low, due probably to the lack of adequate cultivation.

Sweet Potatoes.—Sweet potatoes as grown by local natives give low yields of small roots. As in the case of yams low yields are probably due to the lack of proper soil preparation.

Breadfruit.—This crop is one of major importance on all Polynesian islands and the islands of the East Solomons. It is eaten freshly cooked while in season, and quantities are dried for storage to be eaten at other periods.

Minor Crops.

Bananas.—Bananas are usually inferior types, they are planted in single lines to demarcate plot boundaries, or as isolated plants near villages. Much could be done to improve this crop by planting plots, these if properly attended would provide large quantities of nutritious food, and a reserve supply to tide over times of shortages caused by the partial failure of the taro or yam crops.

Tobacco.—Tobacco is universally grown as isolated plants near house sites. The types grown are very coarse, and produce an inferior strong tobacco.

Turmeric.—Turmeric is grown on small plots to provide clothing and hair dyes.

Vegetables are grown in small quantities, they include Chinese cabbage and species of *Hibiscus* and *Solanum.*

The general standard of native agriculture compares favourably with that of other tropical countries. The preparation of land for planting is as well done as the primitive tools permit. There is little evidence of soil erosion that can be attributed to cultivation, but extensive erosion is not uncommon on village sites, and along bush tracks. In order to reduce the possibility of erosion it would be wise to recommend contour strip cropping with adequate barriers of vegetation or debris between each strip.

1 *Colocasia esculenta* Schm. 2 *Dioscorea* spp.

ECONOMIC BOTANY—WEEDICIDE TRIALS IN VITI LEVU.

By
B. E. PARHAM, M.A.,
Senior Agricultural Officer.

DURING the war, owing to the shortage of manpower and the urgent necessity for increasing food production, research in Britain was early on directed to a study of what are known as selective weed killers. It had long been known, for example, that sulphuric acid under favourable conditions killed the weed of wheat fields known as charlock without doing serious harm to the wheat crop. In conditions of drought, however, it killed charlock but also severely burned the wheat and sometimes killed oats. Sulphuric acid was also difficult to transport and apply to fields. Dry calcium cyanamide was used also and gave fair results—but supplies became unavailable and attention was turned to certain coal-tar products.

Dinitro-orthe-cresol herbicides.—Plant physiologists discovered that by adding ammonium salts to this selective weedicide known commonly as D.N.C., an activated mixture was produced which was more selective and killed a wider range of weeds. These materials are very toxic to broad-leaved weeds and may be applied with ease and safety.

The causes of the selective action have been studied—it was early noted that monocotyledons as grasses (including wheat, oats, etc.), onions and other similar crops were less susceptible to these sprays than dicotyledons (broad-leaved plants). Reasons suggested were that the long leaves of the former caused the spray to run off more easily. It was also discovered that the cuticle of such plants was much less easily penetrated by the chemicals than that of susceptible plants: and finally experiments involving injection proved that the protoplasm of the former showed a much higher resistance to the toxic action of the chemicals. Infiltration through stomata proved of no importance.

It was clear that D.N.C. accelerates metabolism so that the plant uses up oxygen and other nutrients more quickly than it is able to replace them.

There is a stimulation of growth when low concentrations are used and actually the chemical acts as a growth promoting substance. Observations made locally are of interest in this connexion inasmuch as certain leguminous plants which (although at first scorched by the chemical) have recovered and actually shown a stronger growth than before.

It may interest readers to know that this substance has a similar effect on human beings and animals and was at one time used as a slimming agent. Workmen whose skin is heavily contaminated with the substance usually show a loss of weight.

Chlorinated phenoxy-acetic acid.—Another type of weed killer recently made available is based on plant-growth substances which have a toxic effect on plants owing to a selective acceleration of growth.

The hormone reaction in plants is generally well known—and certain synthetic substances have been developed for use to encourage root production, to prevent premature fruit drop and so on. The dosages for these purposes are extremely small—and when applied at a higher rate the effect is to cause serious derangement resulting in death. Plants sprayed develop distorted growth of leaves and the material is translocated in the sap to the roots which may be destroyed.

It is interesting to note that these substances when evaporated in a glass-house of tomatoes will result in the production of seedless tomatoes—they

have a fertilizer action—but are also of considerable importance as weed-killers. The action is usually slower than that of other weedicides—some weeds are not affected but those susceptible are usually completely destroyed within two weeks.

The British trade name of this type of weedicide is Agroxone (the name Methoxone being the trade name of the active constituent—mono-chloro-phenoxcy-acetic-acid). The Agroxone is a ten per cent solution. The American product is known as Tufor-D, or Weedone and is an emulsion (9·6 per cent). It is also available in dust form (Weedex). Both this and the D.N.C. weedicides are manufactured from the same raw product (ortho-cresol). Allied substances are Demoxylon, Denocate and Phenoxyl.

Recently the Department of Agriculture has undertaken a series of trials with these materials with a view to testing their efficacy against certain local weeds. The weeds which are the subject of the present trials are Noogoora Burr, Paddy's lucerne and related species, *Solanum*, Hibiscus Burr, Tobacco weed, Water hyacinth, Nutgrass.

Both weedicides have been used at economic rates of 2 lb and 4 lb per acre and also in combination, as recently it has been discovered that the substances are complementary and when used together result in greater toxicity and wider range. The applications were made in solution at the standard rate of 100 gallons per acre, which is considered the minimum coverage for the type of weeds concerned.

Observations are not yet complete but it may be stated that Agroxone has proved most satisfactory for the control of Noogoora Burr(1), Water hyacinth(2), Goat weed(3), *Oxalis* and Lantana.

D.N.C. has been most effective against Tobacco weed(4), Tarweed(5), Mint weed(6), and the combined spray has completely controlled young plants of Hibiscus Burr(7) and Malvastrum(8).

To date, results with both materials have been inconclusive in the case of *Solanum*, Paddy's lucerne (i)(9) and (ii)(10) and Guava. These plants are severely checked and defoliated at the concentrations used which may not be of sufficient strength. The factor of season and growth has yet to be studied as in the case of certain of the weeds mentioned it is considered that treatment later in the year would be more likely to succeed.

The following grasses have been unaffected or only slightly burned at the standard concentrations used: Australian Blue(11), native blue(12), crows-feet(13), Couch(14), Thurston(15), Seed(16), Para(17) and Sour grass(18). Nut grass also is not severely affected but has been killed at somewhat higher concentrations. The legumes, none of which were affected at all severely are sensitive plant, Kaumoce(19), Trefoil(20), Raintree seedlings(21). Among plants not checked by the treatments is "Drala kaka"(22).

The series of trials which is being conducted in various parts of Viti Levu as part of the investigation scheme of the Department is well under way, the final results and conclusions will be published at a later date.

1 *Xanthium italicum* Moretti.
2 *Eichornia crassipes* Solms.
3 *Ageratum conyzoides* L.
4 *Elephantopus mollis* HBK.
5 *Cuphea carthaganensis* (Jacq.) Macbr.
6 *Hyptis pectinata* (L.) Poit.
7 *Urena lobata* Benth.
8 *Malvastrum coromandelianum* Garcke.
9 *Sida acuta* Burm. f.
10 *Sida rhombifolia* L.
11 *Dicanthium* spp.
12 *Amphilophis globea* (Roxb.) Stapf.
13 *Eleusina indica* (L.) Gaertn.
14 *Cynodon dactylon* Pers.
15 *Brachiaria distachya* (L.) Stapf.
16 *Chrysopogon aciculatus* (Retz.) Trin.
17 *Brachiara mutica.*
18 *Paspalum conjugatum* Berg.
19 *Cassis occidentalis* L., *C. tora* L.
20 *Desmodium* spp.
21 *Pithecolobium saman* Benth.
22 *Vitex trifolia* L.

PEANUT CULTIVATION IN THE KINGAROY DISTRICT OF SOUTH QUEENSLAND.

Compiled by
D. A. DONALD, Agricultural Officer.

Location.—Kingaroy is the chief town of the main peanut producing area in Australia. It is situated in the heart of the South Burnett district of Queensland and the peanut cropping area lies withing the parallels of 26° and 27° south latitude and 151° and 152° east longtitude.

Topography.—The cultivation of the peanut is carried on within an area approximately 40 miles by 15 miles in extent. It is an undulating high plateau ranging between 1,300 feet and 1,500 feet above sea level approximately 100 miles west of the sea coast. It is roughly bounded by slightly higher mountains up to 3,000 feet above sea level which are still largely covered with natural rain forest. The area is traversed by two tributaries of the Burnett river.

Soils.—The soils are sedimentary in form, and of volcanic origin. They may be divided into two classes, viz. (*a*) deep red loam, up to 90 feet in depth and originally supporting rain forests, (*b*) red clay loam, overlying a yellowish red clay subsoil. These soils are only about six inches deep and originally supported hardwood forests. These two types merge one with the other, and they range from fairly acid to neutral (pH 5·1 to 6·5). No recent soil analyses were available but essential elements are considered to be Nitrogen-fair, Phosphoric acid and potash low to fair, and lime adequate. Mechanically the soil is made up of very fine particles which give a misleading impression of heavy clay. This is not so, as good texture and tilth are readily maintained. The arable area covers the flats and slopes of from 4° to 8° from the horizontal.

Climate.—The average rainfall for 34 years to 1939 is:—

January	4·75 inches
February	3·13 ,,
March	3·21 ,,
April	1·67 ,,
May	1·04 ,,
June	1·98 ,,
July	1·42 ,,
August	·96 ,,
September	1·63 ,,
October	2·09 ,,
November	2·87 ,,
December	4·02 ,,
	28·77 ,,

Estimated average	maximum summer temperature	95°
,,	minimum ,,	60°
,,	humidity (relative) 30—40 per cent	
,,	maximum winter temperature	70°
,,	minimum ,,	30°

up to 19° of frost have been recorded in the district and the frequency of frosts varies from five to forty during a winter period. Prevailing winds are south-easterly in the summer and south-westerly in the winter. Rain bearing winds usually come from either the north-east or south-west.

Organization of the Industry.—Control is vested in the Peanut Board which is a "Commodity Board" set up under the Primary Producers Organization and Marketing Acts and the Peanut Industry Protection and Preservation Act. The growers are fully organized in the Peanut Growers Co-operative Association Limited. The industry has been established only about 20 years and appears to be highly protected by the legislation.

The majority of the farmers own their own land on a freehold basis and very few, if any, are encumbered. The average size of farms lies between 160 to 320 acres allowing for a few very small and a few very large. At least 85 per cent of the farm area is arable. The area of peanuts per farm varies from 20 to 200 acres and is considered to average 50 acres. On the best areas where peanuts are the main cash crop and no dairying is practised, and the farm is "fully mechanised" it is considered that one man can farm 150 acres of peanuts, employing labour only for the harvest. According to the quality of the land and the individual this figure will range from 80 to 150 acres. During the war horses were used to a small extent but all farmers are becoming "fully mechanised" as soon as possible. All farmers appear to be well provided with tractors and implements and even during the war it was not found necessary to operate implement and machinery pools. Such shortages as existed were taken care of by private treaty between farmers.

Acreage of peanuts per farm is controlled on a tonnage basis by the Peanut Board. All growers are theoretically tied to a tonnage production quota but at present there is a market for all peanuts produced and to all intents and purposes "licences" are unlimited. Farmers who entered the industry in its early years have a kind of priority with the Board which gives those individuals a higher basic allocation and in the event of future restrictions on production they will receive first consideration. After harvest all nuts produced must be sold to the Board and the tonnage received up to the individual farmers quota is credited to the No. 1 pool. Any nuts produced by that farmer in excess of his authorized quota are credited to the No. 2 pool.

Livestock on Peanut Farms.—Dairying is practically the only branch of animal husbandry associated with peanut culture. In the early days and up till quite recently almost all peanut growers were also dairy farmers. This recession of dairying in the district is due to the increased confidence of the farmer in the stability and profitableness of peanuts as the main crop. The American practice of raising pigs on peanut areas is not practised, as the Australian bacon market will not take heavy soft fatted pigs.

Peanut Trash.—Peanut trash after thrashing, when not required to feed the farmers own dairy stock is baled and sold as a stock food for other districts and is regarded as a profitable sideline.

Other Crops Grown for Sale.—Maize for grain was the main crop of the district before the development of peanut culture, but only a very small area is being cropped at present. Grain sorghums are cultivated on the marginal areas to some extent. On those farms that combine peanuts and dairying, Sudan grass, Oats and Poona Peas may be grown for stock feed either as ensilage or for grazing.

Crop Rotation.—At present there is little organized rotation of crop practised on peanut farms. This is probably due to the high returns from peanuts, the existing unlimited demand for peanuts and the inherent fertility of the soil which to date has shown no very serious results from continuous peanut cropping. The Agricultural Adviser is however much concerned

and he anticipates that with post-war stabilization of the industry, farmers will in the near future adopt organized rotational cropping. The Agricultural Adviser has carried out trials with co-operating farmers and recommends the following rotations for a ten year period.

	Rotation for "straight" farming areas.	*Rotation for mixed dairying and farming.*
1st year	Peanuts	Peanuts
2nd ,,	,,	,,
3rd ,,	,,	Cowpeas
4th ,,	Cowpeas	Maize
5th ,,	Maize	Sudan
6th ,,	,,	Cowpeas
7th ,,	,,	Maize
8th ,,	Rhodes grass	Rhodes grass
9th ,,	,,	,,
10th ,,	,,	,,
11th ,,	Peanuts	Peanuts

No intercropping with peanuts is practised or contemplated.

Soil Erosion.—Soil erosion has not so far developed to any serious extent but some signs of sheet erosion and some minor "gullying" were to be seen. The Agricultural Adviser regards it seriously.

Soil Conservation.—Soil conservation methods using broad based contour terraces have already been adopted by a few farmers and the Agricultural Adviser's staff is available to fix the levels for the contours for farmers to construct the terraces themselves. Planting on contour lines and strip cropping within the terraces is envisaged as regular practice with the adoption of the crop rotations mentioned above.

Land Preparation.—The two most popular implements for land breaking are the four-furrow, 26 inch disc "Sunverticle" plough and the plough cultivator "Sundercut."

The land is ploughed to a depth of six inches in July or August and maintained in a flat broken condition with the Sundercut. Traction used is almost invariably the 16 or 30 h.p. wheel tractor, those with pneumatic wheels are apparently favoured although there are many of the iron wheel and "spuds" fitted type to be seen but crawler type tractors are not favoured. The number of operations depends upon the weed growth and decay of trash and it may be necessary to go over the land five times to secure a satisfactory seed bed, clean and free from trash.

Varieties.—There are three varieties under commercial production in the district. They are all of the "bunch" type as "runner" type varieties were discarded many years ago particularly on account of the difficulty of harvesting.

Virginia Bunch is the most popular variety and covers about 80 to 85 per cent of the total acreage.

Red Spanish variety occupies 14 to 19 per cent of the area.

San Jose or White Spanish type is gaining in popularity but represents less than one per cent of the area.

The Spanish varieties, apart from their relatively high oil content, are favoured principally because they are tolerant of delay in harvesting, the stems remaining tough and firm with little shedding of mature nuts. The white Spanish variety "San Jose" is most attractive in appearance the

shell is a bright very light biscuit shade, and the kernels are pale pink. This particular strain has been selected by the Agricultural Adviser over a number of years on farmer's plots, retaining the toughness and yield quality of the Spanish type.

Seed.—A high degree of purity of strain is maintained by the close control exercised through the Peanut Board. The Agricultural Adviser and his staff make careful inspections throughout the growing period and at harvest time approved fields or portions of fields are harvested, cured and threshed separately and carefully. The bags are branded and when received at the Co-operative Associations "Silos" are set aside for special grading and storage. When planting is about to commence the nuts are shelled, and the kernels graded and "dusted" ready for sowing. All seed sown must be obtained from the Peanut Board and all seed is treated with an organic mercury dust; both Ceresan and Agrosan are applied at the rate of 1 oz. to 20 lb of kernels of Virginia Bunch variety and 1 oz. to 60 lb of kernels of the Spanish varieties.

Plant improvement is a continuous process conducted by the Agricultural Adviser. Many single plant selections are made each year and then pass through intensive trial and selection in plant-to-row plots, multiplication plots, bulk seed plots and so to the farmers. All of this work is carried out on farmers fields who willingly co-operate and show considerable interest in, and appreciation of the work of the Department of Agriculture.

No seeds in shell—only kernels—are used for planting and no other pre-planting treatment than the "dusting" referred to above, is given.

Germination.—Samples of all batches of seed are sent to the Department of Agriculture in Brisbane for precise germination tests. Normal germination is considered to be between 80 and 95 per cent, but crown rot or seedling blight has a marked adverse effect on germination unless seed is treated with the mercurial dust. Ordinary untreated samples approximate a germination of 65 per cent while a similar, but treated sample will give 95 per cent. The germination period of kernels is from five to nine days.

Fertilizers.—Chemical fertilizers are not in general use beyond the application of superphosphate on crops preceeding the sowing of peanuts. The residual effect of the superphosphate is considered beneficial to the peanut crop.

Organic Manures.—There is no general attempt to add organic matter to the soils of the area. Green manure crops are not grown as such. Cowpeas, where grown, are harvested as seed. Peanut vine detrius provides very little organic matter, only a very small proportion of the roots and casual leaf drop, as after threshing the common practice is to bale the residue and dispose of it off the farm. This loss to the farm is more marked as fewer and fewer farmers combine dairying or stock raising of any kind with the cultivation of peanuts.

Some thousand of tons of peanuts annually are handled at the Co-operative Associations silos and a very high proportion is shelled before shipment. No use whatever is made of this waste either as ground shell, ash, or compost or even spread on fields except a few areas close to the "silos."

No compost is made on any of the farms.

Planting.—All peanuts planted are done with mechanical planters usually the double-row maize planter fitted with special peanut plates (obtainable from the International Harvester Co.). These planters cover the seed two to three inches deep on a flat seed-bed, neither hills nor furrows being

used. No significance is considered in the direction of the rows and as mentioned earlier, contour planting is a desiderata rather than a practice.

Spacing.—Somewhat closer spacing than formerly is now practised. With Virginia Bunch variety it is 34 to 36 inches between drills and 12 to 15 inches in the drills, while the Spanish varieties are sown at 30 to 32 inches between drills and six to eight inches in the drills.

Rate.—30 to 35 lb of kernels are required to plant one acre with Virginia Bunch variety and 25 to 30 lb with Spanish varieties at the spacings mentioned above.

Planting Time.—Planting time is usually October and November and may extend into early December. (In Northern Queensland January plantings are common.) The practice is for the later maturing Virginia Bunch variety to be planted first and the Spanish varieties towards the end of this period.

Cultivation of Growing Crop.—Soon after germination and while the plants are still only a few inches tall the field is gone over with light tyre harrows across the direction of the rows. This is regarded as an important operation in weed control and if judiciously done can obviate the need for subsequent hand hoeing. Inter-row cultivation is performed with spring tooth cultivators (see note below on Development of Local Implements) and is carried on as long and as frequently as weed growth requires. It is considered that usually one hand hoeing of weeds in the rows is necessary.

No particular weed menaces the industry and no weed control measures other than the cultivation mentioned is necessary, so long as it is well done.

At the final cultivation just after flowering commences, shaped shoes are used on the cultivator tyres to give a light " hilling " which facilitates the entrance of the fruiting pegs.

Diggings.—Skill and experience is required to decide when the crop is ready to harvest. If gathered too early there will be too many shriveled kernels. If gathered too late some of them will have sprouted. The foliage of the plant usually becomes slightly yellowish at maturity, but not always. At about maturity, odd plants must be pulled and examined. The inside of the shell loses its " fluffiness " and shows dark veins, while the kernel is full and firm; crisp to the bite but without that " milkiness " apparent in the immature nut.

The plants are harvested by " pulling " by hand, but first the top roots are cut by the use of an implement passing a blade through the soil, at about six inches of depth, and below the collection of fruit. Formerly there were various versions of the " peanut cutter " in use. Now all harvesting is done using a locally developed " V " type cutter fitted beneath the tractor and referred to below under Development of Local Implements. This cutter is very efficient in the Kingaroy soils and the operation of " pulling " consists simply of picking up three or four plants in each hand as the puller passes between two rows, shaking the loose soil free, and throwing the plants from two pairs of rows together. Thus a windrow of the plants from each four rows is formed. The cutter is usually put into the field an hour or so ahead of the pullers to assist in the soil shaking free of the plant.

Stacking.—The operations of pulling and stacking require much hand labour, and large numbers of seasonal workers converge upon the district in March of each year. The work is performed on contract and the contract rate per acre is fixed by a committee of local farmers appointed by the Growers Co-operative. Experienced men can earn up to £4 per day while the season lasts—usually not more than two months.

Stacking consists of collecting the plants from two windrows (i.e. eight planted rows) and building " stooks " or " cocks " therefrom. The " stooks " are about 2½ feet in diameter and about three feet high. Experience and skill is required to build a " stook " firm enough to withstand ordinary wind, to throw off any casual rain, and create the conditions within the stook to bring about satisfactory curing of the nuts, and to do all this at a sufficiently fast rate to keep up the contract earnings. No poles are used in the stacking in Queensland. All the nuts are turned to the inside of the " stook ".

Owing to the low average rainfall of the area rain damage is usually very slight. In the past stack-capping was tested and found very effective in protecting the curing stooks in the field from quite heavy rain. This capping consisted of 30 inch squares of " Hesheen "—a tarred paper, sold by Henry Berry & Co. of Brisbane. The squares were split on one side, into the centre, to allow of forming a cone on the stook, and secured by a bent wire pin, through the paper into the stack. These caps could be used many times over.

The curing period for nuts in the stook varies with weather conditions but is from two to four weeks at Kingaroy. Nuts taken from the inside of a stook should taste ripe and brittle, and the husk should slip off the kernel easily if curing is completed.

Threshing or Picking.—Threshing or picking consists of removing the nuts from the vines. This is performed by a machine of which there are two main types (*a*) the picker-thresher and (*b*) the drum type thresher. Representative of the former is the Benthall Peanut Picker, by the Benthall Machine Company, Suffolk, Va. U.S.A. while the latter type is manufactured locally by H. Stolzenberg of Kingaroy.

Threshing is usually performed on a contract basis. Where farmers own their own thresher they usually also do contract threshing for neighbours. Large machines threshing a good crop will do up to 500 bags of clean nuts per day.

The thresher is set up at the most convenient spot and the stooks are carted from the field on low table top waggons. Under humid conditions it is sometimes necessary to put the crop through the thresher twice to remove all the trash.

A thresher team including those carting in the stooks and working the machine is ten to twelve men.

It has become common practice to bale all the vine trash, either as the thrashing proceeds or soon after. The sale of this " hay " is an added source of income but means that valuable organic matter is being sold off the farm.

Yields.—Virginia Bunch is said to yield from 1,750 to 3,250 lb per acre of nuts in shell, and average up to one ton.

Red Spanish yields 1,400 to 2,500 lb and averages close up to 15 or 16 cwts. San Jose—the White Spanish variety is said to be intermediate between these two.

Marketing.—Nuts are delivered to the Co-operative silos more or less as they come from the thresher. They are there recleaned and each farmer's lot is automatically weighed and first payments made.

Pests and Diseases.—The industry is not troubled with any serious pests. The only serious disease is crown rot which has been referred to above.

Peanut Prices.—As a matter of interest the price of peanuts paid to growers from 1939 is given:—

	d. per lb.		d. per lb.
1939	2·180	1943	4·127
1940	2·714	1944	3·86
1941	2·889	1945	*
1942	3·059		

* Not finalized but expected to be about the same as the previous year.

Development of Local Implements.—In the past 20 years, during which the Peanut Industry in Queensland has become firmly established, many kinds and types of implements from various countries, have been used. At the present time the uniformity of type and method of use of implements over such a considerable area and among such a large number of farmers appeared to the writer to be rather remarkable. The choice of ploughs appears to be almost exclusively the four furrow " Sunverticle " disc and the so called cultivator-plough " Sundercut " disc. There is some difference of opinion with regard to threshers. Some farmers still favour the imported picker type " Benthal ", while others prefer the locally made drum type thresher. This drum type machine is made in two sizes, the larger—500 bags per day—is priced at about £450 and the smaller—300 bags per day—at about £400.

With regard to the other implements in use the growers appear to be almost of one mind in selection of type and these are locally built.

The light-tyne-harrows are of conventional design except that the tynes are perhaps longer than is usual. They are supplied by Ellis Bros. Kingaroy, at 27s. per leaf including bar and hitches.

The now widespread use of the high frame pneumatic wheel type tractor of which the McCormich Deering, Farm All Tractor is typical has brought about the use of implements which can be fitted direct to the tractor frame. These have the advantage of being always in view of the driver, all parts are directly under his control, and rigidity and compactness of the unit allow of accurate and efficient performance. Thus, has been evolved locally a composite unit which consists of a stout steel frame which is bolted directly to the tractor chassis, and to which, spring tooth tynes, hilling attachments, or peanut cutters can be fitted as required. This unit is known as the Ellis Row Crop Cultivator and Cutter, and is put out by Ellis Bros. of Kingaroy, at between £40 to £50 fitted to the tractor. The variation in price depends upon the type of tractor and the lesser variations required by the farmer.

ACKNOWLEDGMENT.

I have pleasure in acknowledging the assistance accorded me during the very limited time in Brisbane by the Under-Secretary of the Department of Agriculture and Stock, Mr. Short—by the Director of Agriculture, Mr. McKean—by the Government Chemist, Mr. Von Stieglitz and by the Department of Marketing.

To Mr. J. A. Kerr, Senior Adviser in Agriculture, stationed at Kingaroy, I am particularly indebted, for the bulk of the material which makes up this report, also for the opportunities he provided, to tour the district, to meet farmers and others connected with the industry in Kingaroy district. Mr. Kerr's sacrifice of his time to my needs at a very busy season, is acknowledged and appreciated.

Thanks are also due to Mr. Nisbet, Manager of the Peanut Growers Co-operative, and Secretary of the Peanut Board, for information and the opportunity to see the plant of the Co-operative in operation.

REVIEW.

AGRICULTURAL INVESTIGATIONS IN HAWAII*.

THE report of the Director of the Agricultural Station, Hawaii, which has recently come to hand is the second to be published in three years of war. It contains much valuable information of interest not only to technical workers but also to the general public.

Under the general heading of " Soil and Plant Investigations " are recorded the station's work on vegetable crops and plant diseases, fruits and nuts horticulture, plant physiology, soils and agricultural chemistry and entomology. Of marked importance is the development by the research staff of a tomato variety which has proved resistant to the destructive disease known as spotted wilt. This work has involved the growing to maturity of 30,000 plants for observations on yield, vigour, quality and disease resistance. Valuable work has also been done in connexion with the selection of varieties resistant to the grey leaf-spot disease(1); and breeding for combined resistance is being carried on.

Other breeding work on vegetables has been concerned with beans (resistance to rust); potatoes—(varieties, seed treatment and seed size, disease control); celery (disease control); sweet potatoes (varieties) and miscellaneous vegetables.

Amongst fruits and nuts, valuable work is recorded on papaya (varieties, latex yield and culture), Litchi, Avocado, *Macadamia* and Coffee. It may be mentioned that by the proper choice of varieties, the grower may produce avocado fruits during any part of the year and be assured of satisfactory yields through reciprocal cross pollination.

In the Plant Physiology section valuable work is recorded in the nutritional requirements of sugar cane involving the development of a crop-log for the determination of trends shown by successive crops on a particular field and for comparing performance of fields or plantations.

Means of inducing germination of range grass seeds are also reported upon.

In the agronomy section of the report are to be found descriptions of machines for mechanical harvesting of such robost forage plants as elephant grass, guinea grass and Koahaole, known in Fiji as " Vaivai "(2), which are of immediate concern to dairy farmers and other stock owners.

The frequency and height of cutting, the cultural management and the fertilization of these crops is discussed.

Pasture investigations cover fertilizer treatments, grazing experiments, pasture legumes and studies of localities.

In the Soils and Agricultural Chemistry section are valuable soil studies and studies in the utilization of " Koahaole "(3). As is well known this plant, although a valuable fodder, may cause symptoms of illness and alopecia (loss of hair) in certain animals, as horses, pigs, and chickens. The toxic principle has been identified as mimosine (C_8 H_{10} O_4 N_2). It is present in dry leaves and seeds to the extent of about 3 to 5 per cent respectively. It was found that the simultaneous feeding of certain compounds, notably sodium iron pyrophosphate largely eliminated the toxic effects of Vaivai or of mimosine.

Entomological problems refer to a wide range of insect pests of vegetables with control studies.

Nutrition studies deal with the thiamine content of food (pork, soya beans, rice)—the ascorbic acid content of fruits and vegetables (guava, mangoes, tomatoes)—the Vitamin D content of milk and eggs.

Animal investigations comprise dairy experiments (urea in rations of milking cows, " Vaivai " roughage as a protein substitute and as roughage for dairy heifers, sweet potato meal and elephant grass in dairy cow rations. Silage feeding investigations (elephant grass and other crops).

The feeding of pigs and poultry and parasitology problems are also recorded. In an appendix are listed the research projects in progress at the Station.

From the above brief summary it will be seen that the Report contains much information of direct value to farmers in Fiji but also of interest to technical officers in research and extension services. —B.E.V.P.

* " Shaping the future of Hawaii's Agriculture "—Report of the University of Hawaii Agricultural Experiment Station for the Biennium ending June 30—1944; Unis. of Hawaii Aug. 1945.

[1] *Stemphylium solani.* [2] *Leucaena glauca.* [3] *Leucaena glauca.*

THE APHIDS OR GREEN FLIES OF FIJI.

By R. J. A. W. LEVER, B.Sc., D.I.C., A.I.C.T.A., F.L.S.
Entomologist.

THE family of Aphids or green flies is well known both to the gardener, who finds them on his flowers and lemons, and to the planter whose bananas may be affected with " bunchy top ". This condition is caused by injection of a virus by sucking of the Aphid *Pentalonia nigronervosa* Coq. which is found also in Egypt, Ceylon, Tonga and Queensland. Destruction of the plants by spraying with undiluted power kerosene and subsequent removal of the stool is the only control, drastic as it is.

The following is a tentative check list of our known Aphids with the economic plants they attack:—

- *Aphis gossypii* Glover. Cotton, taro, rice, bean, cowpea, guava, hibiscus(1) and rattlepod(2). [Colocasia]
- *A. maidis* Fitch. Maize.
- *A. citricidus* Kirk = (*A. tavarisi* Del. G.)
- *A. nerii* Boyer. Ipecacuanha, False(3).
- *Cerataphis latanicæ* Bdv. Coconut, sago or ivory palm(4) and banana.
- *Toxoptera aurantii* (de Fonscolombe). Golden showers(5) and cocoa leaves.
- *Rhopalosiphum nymphæ* (L.) Water hyacinth.
- *R. pseudobrassicæ* (Davis). Radish.
- *Myzus persicæ* Sulzer. Radish.
- *Macrosiphum* sp. Radish.
- *Oregma iceryæ* Laing.* On the native reed grass(6).
- *Pentalonia nigronervosa* Coq. Banana.

The most useful ladybirds whose larvæ prey on green flies, are *Coccinella transversalis* F., *C. octopunctata* F. and the smaller *Coelophora inæqualis* F. Control is also achieved by larvæ of Syrphid or hover flies especially *Ischiodon scutellaris* F. and *Syrphus corollæ* F. *vitiensis* Bez.

The writer is indebted to Dr. W. Cottier of the Plant Diseases Division, Auckland, for kindly identifying the material sent during 1945 and also to Mr. W. Greenwood of Lautoka for records published in the *Proceedings of the Linnean Society*, N.S.W., between 1924 and 1941. It is of some interest to note that when Kirkaldy in 1908 published in the same journal his " Catalogue of the Hemiptera in Fiji " he stated he was " unaware of any Fijian aphid records " though able to list seven species of the less well-known white flies or Aleyrodids.

[1] *H. rosa-sinensis.*
[2] *Crotalaria mucronata* Desv.
[3] *Asclepias* sp.
[4] *Metroxylon vitiensis* Wendl.
[5] *Cassia fistula.*
[6] *Miscanthus japonicus.*

* Laing (Nov 45) states he has never described an O. iceryae. Taylor finds [illegible] identification, List No 772 (Aust) 2.iv.46 of O. lanigera (Zehnt.) on Miscanthus in Fiji. R. 1000.

NOTES ON THE FIJI BANANA INDUSTRY.

By
R. A. KABLE, M.B.E.,
Acting Produce Inspector.

To the native population of this Colony, the banana industry ranks next in importance to copra. Many large districts in the island of Viti Levu are unsuited for coconuts; the large number of Fijians in these areas are almost entirely dependent on bananas for their supply of ready cash to meet taxes and to provide purchasing power for clothes and other necessities.

During the war years, with most of our young men serving in the forces, these banana areas were, of necessity, badly neglected. They became diseased and overgrown with weeds. No replanting was possible and the end of 1945 found Fiji bananas to a large extent the product of old, overgrown and diseased plantations. As is normal under these conditions, the quality of the fruit seriously deteriorated.

Immediately the young men of these areas were released from the services they began, with energy, the work of replanting. This was no light task. Apart from the fact that little or no planting had been done for years, large areas on the Wainibuka River were completely devastated by the floods of January 1946. New ground had to be cleared, prepared and planted. With encouragement from the Secretary for Fijian Affairs and the licensed banana buyers for the areas, the work was pushed ahead and has now made satisfactory progress. The next few months should see the result of this work, in the shape of fruit of better quality, cleanliness and good size, coming forward for shipment overseas. It should mean that Fiji bananas will once again be a priority demand of fruiterers and housewives in New Zealand and Canada.

During the war years, possibly because they had a smaller proportion of their young male population serving in the Forces, our Pacific competitors have greatly increased their production and thereby secured a larger share of the New Zealand market than they enjoyed in pre-war days. This was to be expected, for their fruit is good and they were at all times able to give their plantations the necessary care and attention. The position, however, has now changed. We also are now able to exercise that necessary care and attention and our bananas should once again be in the forefront for quality.

Neither our overseas competitors nor our internal transport difficulties are to be under-estimated. Both problems are serious but both can be overcome—the former by the quality of our fruit and the latter by careful organization and hard work.

Few people indeed realize the difficulties that growers and shippers must overcome before Fiji bananas are placed on the ship at Suva wharf. On receiving advice of the exact movements of a banana loading ship, the licensed buyer estimates the time he will require to transport the bananas from the packing station to Suva, and then by native runner, sends word to all growers in his area of the exact time the fruit must arrive at the packing station. Because of the distances involved, this packing notice must reach the Fijian grower at least seven days before the date of packing.

On receiving his instructions, the grower immediately estimates the size of his crop and then begins cutting and collecting bamboo poles and suitable vines for the building of the light rafts (bilibili) which will carry his fruit

over the first stage of its long journey to Suva (sometimes an overall distance of 100 miles). When the rafts are completed, he cuts his fruit, carefully carries it to the bilibili, loads it aboard and covers it with leaves for protection from the sun. Then, with most of his family to assist him, he starts off on the hazardous 30 or more mile trip to the packing station. Hazardous is by no means an exaggeration. Should the river be in flood, it is extremely dangerous —should it not be in flood, the journey is uncomfortable and trying. Unless constant alertness is maintained in negotiating the frequent shallow rapids and obstacles, the grower, complete with bananas and family, finds himself in the river rapidly being rolled downstream.

On the Sigatoka and Wainibuka Rivers the packing stations are situated where a motor road reaches the river bank. The fruit is here unloaded from the bilibili, inspected, packed and then transported to Suva by trucks. With the Waidina and Wainimala Rivers, the problem is more difficult. The packing stations here are at the highest workable point that can be reached by the medium sized river punts. When the grower arrives at the packing station he unloads his bananas and places them on the river bank for inspection, after which he is supplied with cases and packs his fruit. He then helps load it on to the punts, collects payment and starts off on the long trudge back to his village. The bamboo rafts are abandoned; it is far easier for him to walk home and build new rafts for the next shipment than to force his way up river against 30 miles of strong current and rapids.

At this point the buyer takes over the bananas. Although the river below the packing station is almost free of rapids, there are many shallow stretches and the call for all hands to jump overboard and push the laden punts over these shallows is frequent. Should the water level be very low, shovels are used to ease the sandy bed of the river. These river punts are used to take the fruit from the packing station to the main river (a distance of about 12 miles) where the large deep water punts are waiting. The fruit is here transhipped and the large punts towed by launch to the mouth of the Rewa River and thence around the coast to Suva Harbour.

The ideal time for the fruit to arrive at the wharf is about 12 hours before the sailing of the ship. This allows for adequate inspection and ensures that the fruit goes aboard the ship in prime green condition.

Large quantities of bananas which come in from other islands of the group also present problems. It is at times necessary to keep this fruit for four days in the holds of small inter-island cutters. Should rough weather be encountered, hatches must be closed to safeguard the vessel. Notwithstanding every effort being made to maintain adequate ventilation, heat develops in the small holds, gases form and uneven ripening commences. Only rigid inspection and the rejection of all defective fruit on arrival in Suva can ensure that these bananas are accepted for export in the required prime green condition.

Our competitors in the Pacific grow almost the whole of their banana crop within 30 road miles of their port of shipment. This means that their fruit can be transported from the plantations, packed, inspected and placed aboard the ship all within approximately 24 hours.

The concentration of plantations near the port of shipment has not been possible in Fiji and this, as compared with other countries, constitutes a severe handicap in the marketing of our fruit.

BUDDING.

By C. R. VASEY, Agricultural Assistant.

MEMBERS of the public frequently come to officers of this Department to purchase budded stocks, particularly citrus. Due to the tremendous demand, they go away somewhat grieved when told that there are no stocks available. If they only realized how simple and easy budding really is they might try it for themselves and relieve officers for more important duty elsewhere. It is with this in view that this note is prepared to give members of the public an idea how simple and yet fascinating budding is.

People ask why bud, what is the use ? Trees, particularly fruit trees bear much quicker, if they are budded than if they are seedlings. In the case of citrus the seeds do not always produce plants that bear fruit of the same character as that of the parent—in fact they do not " breed true to type." That is to say, if the seed of a very fine orange or grapefruit be planted the fruit obtained from the seedling, when it has grown into a tree may after all be of a worthless character, so that after the trouble of rearing a tree from seed and waiting for years for the produce, nothing but disappointment may be the result. But by adopting the system of budding, the fruit could be reaped in a much shorter time, with the certainty that all the characteristics of the original plant would be preserved.

Budding is a form of grafting which consists of taking an " eye " or bud with a small portion of the bark attached from a young branch and inserting it in a cut made in the stem or branch of another plant. It is essential that the sap be in active circulation, so that the bark may readily become detached when lifted from the wood.

The plant on which the bud is inserted is called the stock and the stocks commonly used in Fiji for citrus budding are the " rough lemon ", i.e. the common bush lemon, and the sour orange. Sweet orange is not recommended as a stock as this is not as disease resistant as those mentioned above.

The seeds of the desired stock should be sown in nurseries or, if the cultivation is not to be carried out on a large scale, it is perhaps better to sow them in boxes. The seeds are best planted from the fruit as they lose their viability on drying, particularly if exposed to strong sunlight. Seeds should be sown three to four inches apart, and there should be six to nine inches between the rows. They should be transplanted when six to nine inches high into rows four feet apart and three feet between each plant in the row. The time may vary, but the young plants may be budded from 12 to 18 months later and ready for putting out in the field when the bud growth is well established.

There are various forms of budding, but that commonly used in Fiji is known as patch or T budding and is performed thus. When the seedling stocks have attained a diameter of approximately half an inch at the height at which the bud is to be inserted, that is about 15 to 18 inches above ground, budding may be done. The bud wood should be selected from mature trees of a known calibre, bearing satisfactory crops of fruit true to the varietal type. Buds are cut from wood about the thickness of a pencil. In order to facilitate budding operations the trunks of the stocks should be pruned clear of leaves and thorns up to the height at which the bud is to be inserted. The cut in the bark of the stock is made in the form of an inverted T the downward cut being about one and a half inches long. A cross cut of half an inch is then made across the bottom of the vertical cut, thus constituting an inverted T shape cut. When making these cuts, care should be taken to see that the wood underneath the bark is not injured.

The bud is now cut from the bud stick which is held with the basal end away from the operator. Remove the bud from the stick, by entering the knife half an inch below the bud and sloping the knife outwards above the bud. This will give a shield shaped piece of bark and wood, approximately one inch long. Macmillan advocates removing the small piece of wood, but it is not recommended for the amateur, as the heart is apt to be torn out of the bud in the process.

Raise the bark carefully of the incision on the stock and insert the bud right side up, pushing it far up in the vertical cut. A ligature of tape is now bound around the bud so that it is bound firmly and to protect the bud from weather. After three or four weeks the tape may be removed and if the bud is still green and showing callous formation, it indicates that it has "taken." If the bud has turned a brownish colour, it is dead and the work will have to be done again in another place.

As soon as the bud starts to grow the top of the stock should be cut off a little above the bud, to force the sap into the bud. As the bud grows a stake should be provided to promote straight growth of the trunk.

As the tree makes growth, all side branches must be rubbed off, as well as any new growth below the bud union.

When the tree is about three feet high it should be cut back to 30 inches, this being done to promote the growth of the "canopy." Shoots will be thrown out, three or four equally spaced round the trunk being chosen and the rest removed.

After about six months growth of the bud, the whole tree may be removed and planted in its permanent position. Under good conditions the first crop of fruit may be seen in two years.

No other tree, perhaps, responds so readily to judicious manuring as citrus. In Fiji tests have shown that citrus trees need a large amount of nitrogen, so growers cannot expect good crops of fruit unless they give liberal dressings of farmyard manure. When in full bearing the trees should be manured every year.

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AGRICULTURAL NOTES.

1. CANDLENUTS.

The establishment recently in Suva of a mill to extract oil from the fruit of the candle nut tree(1), has had quite a considerable effect on the incomes of the natives of Viti Levu. They were called upon to supply the raw material for this mill and this they have done in rapidly increasing proportions over the past few weeks.

The first order for the nuts in the province of Nadroga and Navosa was for ten tons and was placed towards the end of May. It was estimated that this province could gather and ship two tons of nuts per week and a further order was placed with the natives accordingly. After a slow beginning, one of the Chinese storekeepers in Sigatoka was interested in the business and he agreed to buy and ship on behalf of the Company in Suva.

The first shipment was made on the 26th and 27th June and amounted to eight tons seventeen hundredweights and was obtained from the villages along the coast from Korotogo to Namatakula. As the word got about that there was a market for candle nuts more and more started gathering

them. It was intended at first to make fortnightly shipments, but it was soon seen that the nuts were coming in too fast for that and at the time of writing at least one truck a day goes to Suva taking five or six tons.

Up to the present only the coastal areas from Lomawai to Namatakula have been exploited, and as the supplies from these areas start to taper off then candle nuts from up the Sigatoka valley will be brought in.

The total quantity bought and shipped to Suva from the 26th June, 1946, to the present (24th August) is 215½ tons. It is not expected that the candle nuts will continue to come in indefinitely in such phenomenal quantities; this is the accumulation of years. After this quantity is cleaned up there will only be the annual fall of nuts; what quantity this will yield remains to be seen; perhaps fifty to seventy-five tons a year.

The price paid to the sellers is £5 per ton on the roadside, so it will be seen that this is quite a profitable industry for the natives of Nadroga.

The oil expressed from the nut is of a high grade and in great demand for use in paints. It is very similar to Tung Oil.

Another possible use for the kernel of the candle nut is in confectionery. One of the large chocolate manufacturers in Australia has been approached *re* the possibility of using the nut incorporated in chocolate.

The nut may also be eaten fresh, it is very palatable, but it is reported to be somewhat laxative. —C.R.V.

[1] *Aleurites moluccana.*

2. REFRIGERATION ON THE PLANTATION.

Mr. P. McConnell of Mt. Vernon Estate, Taveuni, has kindly communicated the following notes regarding a freezing chamber which he has recently installed at the Waitavola Estate, adjoining the Government Station at Waiyevo.

"The freezer, which is of cement (a box within a box), is insulated with eight inches of coconut fibre dust packed between the two cement walls which are each three inches thick reinforced with ½ inch to ⅜ inch mild steel rods. The floor is floating on cement slabs and is also insulated. The freezing chamber should carry approximately two tons of all requirements, such as one or two carcases of beef, pork and small goods, sausages and frozen mutton which I hope to procure through a Suva butcher.

The freezing chamber also has a cement brine box for corned beef.

The ice tank is of heavy steel and will hold 10 x 56 blocks of ice daily. It is let into the cement and insulated in the same way as the freezer. Water for ice is carried by pipes from a spring eleven chains away and is fresh and pure.

The plant has been installed by Messrs. Berry & Company, Engineers, Marks Lane, Suva, and comprises a 3 h.p. Baker machine compressor using ammonia and driven by a water wheel of three feet diameter, which has a head of 86 feet. From dam to the Pelton wheel we have put down approximately 226 feet of 6 inch pipes. The installation is really a very fine one, the whole plant being under cover of a well-constructed building.

About 35 years ago Mr. T. Montgomery had a small freezer on the same place, but as it was built of wood it soon fell out of order. The Pelton wheel I am using is the same that he had and so cannot be over 40 years old. It was made by A. G. Price, Thames, Auckland and is developing over 8 h.p.

The adjoining Government Hospital and residents, as well as the Buca Bay planters obtain ice and beef three times a week."

3. YOUNG FARMERS' CLUBS.

OVER the last 14 years in England and other parts of the Empire much interest has been displayed in the formation of Young Farmers' Clubs. These are voluntary youth organizations of the countryside which have for their aim the suitable training of their members so that they may become "good farmers, good countrymen and good citizens."

The size of such Clubs must depend on their location. In England it is found that a membership of 40–45 drawn from an area with a radius of three to three and a half miles forms an ideal number for an efficient club, with the age of members ranging from 10–25 years, of whom at least 50 per cent are in the age group 14–21 years and office bearers under 21 years of age.

The club should be a democratic self-governing unit where young people may get experience in shouldering responsibility and in conducting their own movement.

Club members have an important part to play, not only as club members but also as members of an important youth movement.

Leadership is essential in any society or club, the leader being selected by the members. He or she should be the servant and not the "boss" of the club, acting as co-ordinator, counsellor, guide and friend, remaining in the background so that the Club members may assume necessary responsibility. Should a prominent and trustworthy member be chosen for leadership of his Club, he should cease to be a member, thus losing his vote in the Club and the opportunity of taking part in any of the competitions. It is advisable therefore (in the first instance) to appoint a leader from those who are above membership age, until an active member who has pronounced abilities and who has attained the age limit (25 years) can be chosen for the post.

The leader should be tactful, sympathetic, patient, strictly impartial, of a cheerful disposition, strict integrity, a capable organizer and co-ordinator.

Every effort should be made to secure and maintain the interest, not only of Club members but also of their parents and prominent citizens of the area.

Remember, a slack leader usually means a slack club.

Efforts made in this Colony in 1945 by the staff of the Agricultural Department to institute Young Farmers' Clubs met with some success at the Indian schools at Korotari (near Labasa), Vanua Levu and Kavanagasau, Sigatoka District of Viti Levu, in each case an organizer, secretary and committee being drawn from amongst the school staffs. Meetings were held during the year as far as circumstances allowed; and at Korotari, papers of agricultural interest were read and opportunity taken to take members in to Labasa to see a film "Irrigation in the Punjab." In 1946 a maize growing competition has been organized amongst the members.

At Kavanagasau, the year's activities finished up with an agricultural show organized by the Young Farmers' Club which was enthusiastically supported by the members, their parents, teachers and prominent local citizens. Classes for vegetables, poultry, cattle, goats, dogs rope and whip making and flowers were provided; and a ploughing competition for which six entries were received, was most popular. Prizes such as spades, forks, rakes, cane knives were donated by the School Committee, and by local citizens, while the Government, through the Agricultural Department, donated six Black Australorp cockerels and some budded citrus trees.

It is expected that the interest displayed and the example set by the two foregoing Young Farmers' Clubs will "take on" throughout Fiji to the benefit of agriculture in general and young farmers in particular. —H.R.S.

EXTRACTS.

1. FINDING USES FOR WEEDS.

In 1933, Dr. Berkman, a Russian physician and scientist working in America, started chemurgic researches on milkweed. There are many species of milkweed, of which 40 grow in North America alone, from which he and his co-workers had to choose. Finally it was found that the common milkweed(1), was most suitable*. This is an erect perennial weed, two to five feet tall, from which seeds bearing long silky fibres are collected in Autumn. When the Japanese occupation of the East Indies cut off supplies of kapok—used for stuffing life-jackets as well as mattresses and cushions—the silky floss of milkweed became a valuable substitute. The buoyancy of the floss is as good as kapok and six times better than that of cork; a life-jacket which contains 3 lb of floss will support a man for four days in water. It is warmer and lighter than wool. If the floss is first soaked in a dewaxing solution, then washed and agitated in a colloidal adhesive solution of latex rubber, an insultating felt is obtained. The milkweed, however, has more surprises in store. Its leaves and stem contain one to four per cent " rubber." Last year a pilot plant was erected and a milkweed " rubber " obtained which, when mixed with Buna S synthetic rubber, gave a product of increased tear-resistance and flex life, though tensile strength was reduced. Other uses are: from the pods are used the seeds for semi-drying oil and for oil cake, the floss for life preservers, insulation and felt, the shells for plastics, resins, etc.; the stalk provides bast fibre for textile yarn and alpha cellulose used in the manufacture of rayon, photographic film, paper and munitions—also woody fibre from which plastic ware, gums and rubber is obtained; the leaves provide rubber, pigment and paper; the shoots are edible and the roots are a source of alkaloids. Like many successful weeds, it will thrive on poor soil, and is immune against insect attack. If it maintains its promise, it will soon cease to be a weed.

During the war a job has been found for yet another weed. The water-hyacinth(2), which has very decorative mauve flowers, is a pest in Bengal and other parts of India where it clogs the waterways, killing off fish and upsetting river transport. The Indians call it the " Lilac Devil." Masses of it have been netted and towed out to sea; looms have been constructed in rivers to check its spread. Crushing the plants between rollers mounted on barges has been tried. Owners of ponds have been compelled by legislation to destroy the weed. The Administration set up an expensive experimental factory with the aim of extracting potash salts from the collected weed. But not until 1938 did the Department of Industries hit upon a successful line of attack. The Department found a way of utilising it in the manufacture of plastics; the process which has been worked out and patented is said to be simple and cheap, a company has been set up to develop it and the products are said to be in demand. The money derived from this industrial use more than pays for the cost of collecting the weed.

1 *Asclepias syriaca.* 2 *Eichhornia crassipes.*

* Occasionally seen in Fiji gardens and a close relative of the False Ipecachuana or Blood flower (*A. curassavica*), a common local weed. (Ed.)

2. NEW USES FOR FARM CROPS.

A CENTURY ago, over four-fifths of all products used by man came from the field or forest: to-day probably not more than a third (by weight) of all products used by men, inclusive of food and clothing, are of agricultural origin.

It would be a mistake to ascribe this change solely to the increased demand for food. Though of course, food-growing is agriculture's first priority, it has also—together with forestry—the indisputable task of providing cotton, wool, rubber; tallow and oil for candles, soap, glycerine and plastics; hides for leather, bones for glue; wheat and potatoes for power alcohol and synthetic rubber; cellulose for explosives, films and lacquers; casein, soya beans, peanuts, egg white and other protein-containing matter for fibre manufacture. There are many other raw materials of agricultural origin, such as kapok, pyrethrum, sisal, oat hulls (husks), jute, cotton, wheat straw and bagasse, and from these are derived thousands of different manufactured products.

It is the task of chemurgy to apply the principles of chemical technology to the elaboration of agricultural products, thereby not only opening up new resources for industry but also adding a new value to the products of the farm and forest, bringing new crops into large-scale cultivation and thereby contributing to the prosperity of the farmer and the country.

Farm products used in the United States for process industries.

Farm Products.	1943 Production.		Estimated percentage used in process industries.
Maize	3,076,159,000	bushels	12
Wheat	836,298,000	,,	5
Rye	57,673,000	,,	10
Barley	322,187,000	,,	20
Flax seed ..	52,008,000	,,	95
Rice	70,025,000	,,	3
Sorghums ..	103,168,000	,,	5
Soya beans ..	195,762,000	,,	90
Cotton seed ..	5,390,000	tons	80
Cotton linters ..	1,168,000	bales	90

The development of many parts of the British Empire is likely to be affected by progress in chemurgy. For instance, peanuts, one of the Empire's staple crops, can become an important source of synthetic textiles. "Ardil" is an example of such a textile fibre; 500 pounds of it can be made from a ton of peanuts, and it is likely to be cheaper than wool. A 50 per cent "Ardil and 50 per cent wool" mixture is hardly distinguishable from pure wool.

Peanuts are grown in India and other places in the Empire, and their full utilization exemplifies a promising case where the co-operation of different parts of the British Commonwealth could bring prosperity to all parties concerned. In India alone the area under peanuts, or groundnuts as they are also called, is about six million acres, producing each year nearly 2½ million tons of unshelled groundnuts. Groundnuts consist of 24–26 per cent hulls (husks), 33–36 per cent of oil and 40–42 per cent of protein-containing cake. While the edible oil is used both locally and for export—for making "vegetable ghee" and margarine respectively—the hulls have found hardly any use except for burning under boilers. The residual cake after oil expression or extraction is, on the other hand, a valuable highly nutritive cattle

food. It contains about 45 per cent recoverable proteins, or about 450,000 tons of useful proteins are available in India annually. This is a tremendous reservoir of wealth. The quantities used for the manufacture of the synthetic wool "Ardil" are at the moment, of course, only a fraction of the above figure. A certain amount of cake will not become available for chemurgic purposes since it will have to be used as heretofore as a cattle food to support milk and meat production.

[M. K. Schwitzer—"Chemurgy—New Uses for Farm Crops" *Discovery*, March 1946.]

OBITUARY.

Mr. F. L. FADDY.

THE death of Mr. Francis Leopold Faddy, at the age of 54 years, occurred at the Colonial War Memorial Hospital, Suva, on 18th August, 1946, after a short illness.

Mr. F. Faddy served in the first World War and suffered injuries including gassing which permanently affected his health. After the war, Captain Frank Faddy was adjutant of an Indian regiment and on his return to Fiji became an active member of the Returned Sailors and Soldiers Association and Secretary.

He was for many years intimately associated with the banana industry, particularly as Secretary to the Banana Export Pool, Suva, which appointment he held until his death. He was also a foundation member of the European Electors Association, and his death represents a great loss to the community.

Our sympathy goes out to his widow, Mrs. F. Faddy and son, who survive him.

He was accorded a military funeral, at which the Bishop of Polynesia officiated.

Mr. N. H. MACDONALD.

THE death occurred at the Colonial War Memorial Hospital, Suva, on 24th July, 1946, of Mr. Norman Hodgson MacDonald, at the age of 80 years, after a short illness.

Mr. MacDonald was a son of the late Hon. William MacDonald, of Marre Hall, Custos Retulorum (Keeper of the Rolls) of St. Mary and Metcalfe, Jamaica, B.W.I.

He came to Fiji in 1884 and was intimately associated with the early sugar cane and banana industries of this Colony, being in charge of one of the largest banana plantations at Viria, Province of Naitasiri, up to 1914.

From 1914 to 1930 he was associated with the principal banana buying company in the Colony; after which he engaged in dairy farming for a number of years. Up to within a few weeks of his death he held the post of Parks and Gardens Overseer under the Suva Town Board.

He was associated with the Department of Agriculture from 1929 onwards, being employed as a Plantation and Banana Inspector, and referee of banana packing stations. When the Department of Agriculture undertook trial shipments of banana bunches to Canada in 1932, his knowledge and experience was freely made available to officers of this Department.

The Director and Staff extend their sympathy to the members of his family.